R.E.M. (Rekayasa Energi Manufaktur) Jurnal | Vol.7 No.1/2022
ISSN online (2528-3723)
http://doi.org/10.21070/r.e.m.v7i1.1642

Washbasin Design with DFMA Approach for Covid-19 Prevention

Iswanto[1*], Ribangun Bamban Jakaria[2], Boy Isma Putra[2], Marzuki Ibrahim[3]
[*]Email corresponding author: iswanto@umsida.ac.id

[1]Department of Mechanical Engineering, Muhammadiyah University of Sidoarjo, Indonesia
[2]Department of Industrial Engineering, Muhammadiyah University of Sidoarjo, Indonesia
[3]Faculty of Innovative Design and Technology, Universiti Sultan Zainal Abidin, Kuala Terengganu, Malaysia

Article history: Received: 17 April 2022 | Revised: 19 Mei 2022 | Accepted: 20 Mei 2022

Abstract*. The Covid 19 pandemic makes the need for a washbasin in a public place to prevent the spread of the virus. However, in practice the available washbasins are still not standardized and not ergonomic. So that in this study an ergonomic washbasin design was tried using the DFMA (Design for Manufacture and Assembly) method. Because using the DFMA method aims to improve the design. Through this method, it is possible to produce products with a shorter time and the number of components that are more effective in accordance with the function but have better design quality. In this study there were several components that were repaired, combined and removed, but did not change the function and usability of these components. So that this research resulted in a sink design that is modern, multifunctional, easy to use and comfortable.*

Keywords - *DFMA method, washbasin design, ergonomic, Covid-19 prevention*

INTRODUCTION

Early 2020, Corona Virus Disease-2019 (Covid 19) began to become a disease outbreak that spreads very rapidly throughout the world, including Indonesia. This disease was first detected in the Chinese city of Wuhan [1–3]. In mid-March 2021, it was confirmed that the number of positive cases of the Corona virus in Indonesia reached 1.4 million positive cases with a death toll of 38.7 thousand people [4]. One way to prevent the spread of the corona virus is to wash your hands frequently with soap and rub them evenly for 20 seconds to keep your hands clean and free from viruses [5, 6].

Various circulars and instructions from the government have also begun to encourage people to wash their hands frequently, so that people, government agencies, and public places have begun to be advised to build public washbasin that can be used to wash their hands in order to prevent this virus [7]. However, of the various types and models of washbasin products that are marketed or made that are placed in a number of malls, campuses, schools, government and private buildings, it turns out that they are still not fully able to provide the function as desired by consumers. Consumers buy or make these washbasin because of a need, but in terms of their use, there are still many aspects that become consumer complaints [8, 9]. In this study, to design an ergonomic and multi-functional washbasin to minimize the spread of covid-19 is to use the DFMA (Design for Manufacture and Assembly) method.

The DFMA method is one of the techniques used in product development and improvement which aims to make the manufacturing process easier and reduce assembly costs. The DFMA method provides many benefits, namely improved quality, reduced number of components, simpler assembly processes, and reduced production costs [10].

The DFMA method can also be used to help designers improve quality, reduce assembly costs, and to measure product design improvements [11, 12]. The purpose of this DFMA is to determine product designs that can completely eliminate unnecessary components or components that do not have added value in producing products based on the functions that consumers want. Where the highest expected value can be obtained by providing the maximum function and the lowest possible cost. As well, DFMA is also used to study competitor processes and products in terms of design, quality, material selection, components, production processes and then evaluate assembly and / or manufacturing difficulties in an effort to design superior products based on the results of detailed analysis [13].

Research on product design using the DFMA method has been conducted before, including research conducted by Lachiram et al. about Development of Microwave Ridged Horn Antenna using DFMA Approach [14]. Research about Design Efficiency Analysis Towards Product Improvement for Eco Friendly Using DFMA Method, conducted by Mohd Nizam Sudin et al. [15]. As well as research conducted by P. F. Bariani et al. about A combined DFMA and TRIZ approach to the simplification of product structure [11].

METHODS

In designing and simulation, software that supports technically is used so that the design results can be displayed visually without first being realized. The design process is carried out using a computer with solid work software [16–18]. The stages carried out in this study include:

Identification of problems

This stage of the problem identification process is carried out to clearly identify the problems that occur in the existing washbasin. At this stage, direct field observations were made.

Data Collection and Needs Identification

This stage is a way of collecting data in the form of clearly knowing the function of each component before the design development is carried out. The data collection process at the next stage is carried out by conducting interviews with washbasin users, so that information will be obtained whether there is a need for development of the existing washbasin.

Make Design Development

This stage is the stage where a new design is made using the DFMA method, a new design that will be made based on an analysis of the existing needs of the washbasin.

Product Design Analysis

Product design analysis to determine whether the new product design is in accordance with the research objectives, namely to increase the efficiency of the manufacturing and assembly processes in washbasin products.

RESULTS AND DISCUSSION

There are several design improvements of washbasin products with the DFMA method, in order to increase the efficiency of manufacturing and product assembly time. From the design carried out and the changes obtained after using the DFMA method, it can be seen in figures 1 and figure 2.

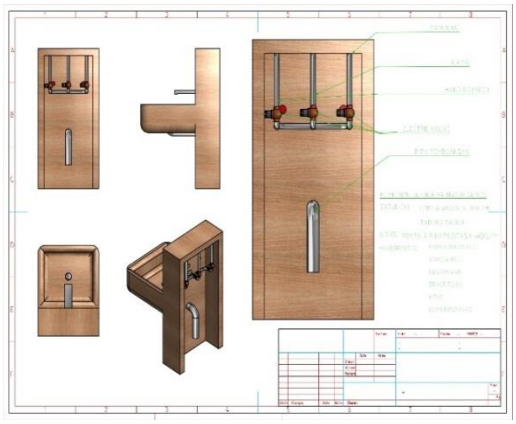

Figure 1. Design before using the DFMA method.

After designing with the DFMA method, the washbasin design looks more flexible and the number of parts is less, this is due to design improvements and eliminating unnecessary components. This of course has an effect on the design time and also the costs required. Thus providing better efficiency and product quality values.

There are several improvements to the washbasin design using the DFMA method, in order to increase the efficiency of manufacturing and product assembly time. Design improvements to several components of the washbasin can be seen in figure 2. From figure 2 it can be seen that the design of the washbasin has changed in several components. In addition, in the repair design using DFMA, the non-functioning parts found in the washbasin are removed to make it easier in the manufacturing process and reduce production costs.

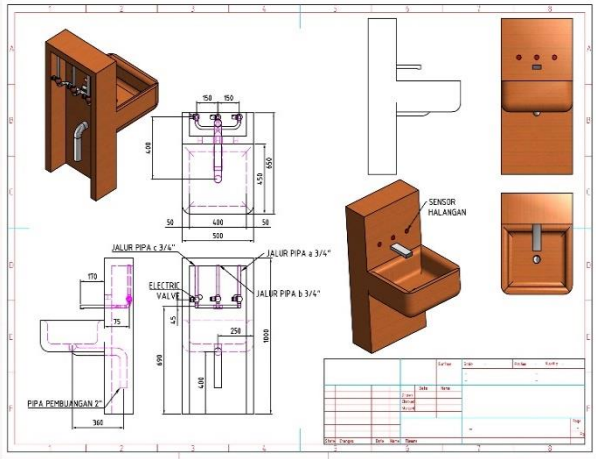

Figure 2. Design after using the DFMA method.

CONCLUSION

The washbasin designed using the DFMA (Design for Manufacture and Assembly) method has a modern, multi-functional, easy to use and comfortable design. There are several components that are repaired, combined and eliminated, but do not change the function and usefulness of these components. With the result of this development, the assembly process becomes easier and the time required is shorter for each unit of product when compared to the old design.

ACKNOWLEDGMENT

The author expresses his gratitude to the Directorate of Research and Community Service (DRPM), Muhammadiyah University of Sidoarjo who has funded this research.

REFERENCES

[1] Rabi, F. A., Al Zoubi, M. S., Kasasbeh, G. A., Salameh, D. M., and Al-Nasser, A. D., "SARS-CoV-2 and Coronavirus Disease 2019: What We Know So Far," Pathogens, Vol. 9, No. 3, P. 231, 2020.
[2] Sun, P., Lu, X., Xu, C., Sun, W., and Pan, B., "Understanding of COVID-19 based on current evidence," Journal of Medical Virology, Vol. 92, pp. 548–551, 2020.
[3] Singhal, T., "A Review of Coronavirus Disease-2019 (COVID-19)," The Indian Journal of Pediatrics, Vol. 87 No. 4, pp. 281–286, 2020.
[4] Worldometers. COVID-19 Coronavirus Pandemic. 2021. https://www.worldometers.info/coronavirus/.
[5] Ouassou, H., Kharchoufa, L., Bouhrim, M., Daoudi, N. E., Imtara, H., Bencheikh, N., Elbouzidi, A., and Bnouham, M., "The Pathogenesis of Coronavirus Disease 2019 (COVID-19): Evaluation and Prevention," Journal of Immunology Research, pp. 1–7, 2020.
[6] Organization, W. H. Water, sanitation, hygiene, and waste management for SARS-CoV-2, the virus that causes COVID-19: interim guidance. World Health Organization. 29 July 2020.
[7] Susilo, A. et al., "Coronavirus Disease 2019: Tinjauan Literatur Terkini," Jurnal Penyakit Dalam Indonesia, Vol. 7, No. 1, 2020.
[8] Syuen, W.W., Nirmal, U., Efzan, M.N.E., and Al Shalabi, A., "Review on Research and Developments of Sinks for Various Applications," Current Journal of Applied Science and Technology, Vol. 35, No. 3, pp. 1-26, 2019.
[9] Çağan, S.C., Buldum, B.B., and Özkul, I., "Design study with height adjustable washbasin," International Advanced Researches and Engineering Journal, Vol. 02, No. 03, pp. 282-286, 2018.
[10] Miles, B. L., "Design for Assembly—A Key Element within Design for Manufacture," Proceedings of the Institution of Mechanical Engineers, Part D: Journal of Automobile Engineering, Vol. 203, No. 1, pp. 29–38, 1989.
[11] Bariani, P.F., Berti, G.A., and Lucchetta, G., "A combined DFMA and TRIZ approach to the simplification of

product structure," Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture, Vol. 218, No. 8, pp. 1023-1027, 2004.
[12] Barbosa, G.F., and Carvalho, J., 'Design for Manufacturing and Assembly methodology applied to aircrafts design and manufacturing," IFAC Proceedings, Vol. 46, No. 7, pp. 116–121, 2013.
[13] Ngatilah, Y., Pulansari, F., Ernawati, D., Pujiastuti, C., Parwati, C.I., and Prasetyo, B., "Design for Manufacture and Assembly for Product Development (Case study: Emergency Lamp)," Journal of Physics: Conference Series, 953 012235, 2018.
[14] Lachiram, Suraj, E.S., and Soni, J.S., "Development of Microwave Ridged Horn Antenna using DFMA Approach," International Journal of Engineering Research & Technology (IJERT), Vol. 5, No. 10, pp. 12-16, 2016.
[15] Sudin M.N., Chin, N.S., Shamsudin, S.A., and Yusuff, M.A., "Design Efficiency Analysis Towards Product Improvement for Eco-Friendly Using DFMA Method," The Open Mechanical Engineering Journal, Vol. 10, pp. 173-181, 2016.
[16] Iswanto, dkk., "Rancang bangun mesin pencoak pipa (pipe notcher) multi dimensi," Jurnal METTEK, Vol. 6, No. 2, pp. 111-120, 2020.
[17] Mulyadi, dkk., "Rancang bangun jig penyambung pipa multidimensi," Prosiding Senaspro, Universitas Muhammadiyah Malang, pp. 309-318, 2017.
[18] Adamsyah, M.S. & Mulyadi, "Perancangan Alat Pengering Kerupuk dengan Menggunakan Pemanas Heater," R.E.M (Rekayasa Energi Manufaktur) Jurnal, Vol. 4, No. 1, pp. 27-51, 2019.